Laborator si seminar

Programare in Java si software matematic

Adrian Ichimescu

Adrianichimescu@gmail.com

Drawing math functions in Java

Drawing f(x) function is Java:
- AWT
- JavaFX
- Jfreechart framework

jfreechart
How to install?

Where to download it from?
Is available on different sources:
    - jfreechart web site

    -maven

 To install add new Maven Project editing pom.xml file

Here is a demo in YouTube

What is jFreeChart offers to us?

JFreeChart is a free 100% Java chart library that makes it easy for developers to display professional quality charts in their applications. JFreeChart's extensive feature set includes:

- a consistent and well-documented API, supporting a wide range of chart types;

- a flexible design that is easy to extend, and targets both server-side and client-side applications;

- support for many output types, including Swing and JavaFX components, image files (including PNG and JPEG), and vector graphics file formats (including PDF, EPS and SVG);

- JFreeChart is open source or, more specifically, **free software**. It is distributed under the terms of the **GNU Lesser General Public Licence** (LGPL), which permits use in proprietary applications.

jFreeChart examples BarChart

```java
import org.jfree.chart.ChartFactory;

public class AreaChartEx extends JFrame {

    public AreaChartEx() {

        initUI();
    }

    private void initUI() {

        CategoryDataset dataset = createDataset();

        JFreeChart chart = createChart(dataset);
        ChartPanel chartPanel = new ChartPanel(chart);
        chartPanel.setBorder(BorderFactory.createEmptyBorder(15, 15, 15, 15));
        chartPanel.setBackground(Color.white);
        add(chartPanel);

        pack();
        setTitle("Area chart");
        setLocationRelativeTo(null);
        setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
    }

    private CategoryDataset createDataset() {

        double[][] data = new double[][]{
                {82502, 84026, 85007, 86216, 85559, 84491, 87672,
                        88575, 89837, 90701}
        };

        CategoryDataset dataset = DatasetUtils.createCategoryDataset(
                new String[]{"Oil"}, new String[]{"2004", "2005", "2006",
                        "2007", "2008", "2009", "2010", "2011", "2012", "2013"},
                data
        );

        return dataset;
    }

    private JFreeChart createChart(CategoryDataset dataset) {

        JFreeChart chart = ChartFactory.createAreaChart(
                "Oil consumption",
                "Time",
                "Thousands bbl/day",
```

jFreeChart examples LineChart

```java
1⊕ import org.jfree.chart.ChartPanel;
8
9  public class LineChart_AWT extends ApplicationFrame {
10
11⊖     public LineChart_AWT( String applicationTitle , String chartTitle ) {
12         super(applicationTitle);
13         JFreeChart lineChart = ChartFactory.createLineChart(
14             chartTitle,
15             "Years","Number of Schools",
16             createDataset(),
17             PlotOrientation.VERTICAL,
18             true,true,false);
19
20         ChartPanel chartPanel = new ChartPanel( lineChart );
21         chartPanel.setPreferredSize( new java.awt.Dimension( 560 , 367 ) );
22         setContentPane( chartPanel );
23     }
24
25⊖     private DefaultCategoryDataset createDataset( ) {
26         DefaultCategoryDataset dataset = new DefaultCategoryDataset( );
27         dataset.addValue( 15 , "schools" , "1970" );
28         dataset.addValue( 30 , "schools" , "1980" );
29         dataset.addValue( 60 , "schools" ,  "1990" );
30         dataset.addValue( 120 , "schools" , "2000" );
31         dataset.addValue( 240 , "schools" , "2010" );
32         dataset.addValue( 300 , "schools" , "2014" );
33         return dataset;
34     }
35
36⊖     public static void main( String[ ] args ) {
37         LineChart_AWT chart = new LineChart_AWT("School Vs Years" , "Numer of Schools vs years");
38         chart.pack( );
39  //      RefineryUtilities.centerFrameOnScreen( chart );
40         chart.setVisible( true );
41     }
42 }
```

jFreeChart examples PieChart

```java
 4⊕ import javax.swing.JPanel;⎵
12  //import org.jfree.chart.ui.RefineryUtilities;
13
14
15  public class PieChart_AWT extends ApplicationFrame {
16
17⊖     public PieChart_AWT( String title ) {
18          super( title );
19          setContentPane(createDemoPanel( ));
20      }
21
22⊖     private static PieDataset createDataset( ) {
23          DefaultPieDataset dataset = new DefaultPieDataset( );
24          dataset.setValue( "IPhone 5s" , new Double( 20 ) );
25          dataset.setValue( "SamSung Grand" , new Double( 20 ) );
26          dataset.setValue( "MotoG" , new Double( 40 ) );
27          dataset.setValue( "Nokia Lumia" , new Double( 10 ) );
28          return dataset;
29      }
30
31⊖     private static JFreeChart createChart( PieDataset dataset ) {
32          JFreeChart chart = ChartFactory.createPieChart(
33              "Mobile Sales",    // chart title
34              dataset,           // data
35              true,              // include legend
36              true,
37              false);
38
39          return chart;
40      }
41
42⊖     public static JPanel createDemoPanel( ) {
43          JFreeChart chart = createChart(createDataset( ) );
44          return new ChartPanel( chart );
45      }
46
47⊖     public static void main( String[ ] args ) {
48          PieChart_AWT demo = new PieChart_AWT( "Mobile Sales" );
49          demo.setSize( 560 , 367 );
50          //RefineryUtilities.centerFrameOnScreen( demo );
51          demo.setVisible( true );
52      }
53  }
```

jFreeChart examples Histogram

```java
1 import org.jfree.chart.ChartFactory;

8
9   public class PieChart_Histogram {
10
11      public static void main(String[] args) throws IOException {
12
13          double[] vals = {
14
15                  0.71477137, 0.55749811, 0.50809619, 0.47027228, 0.25281568,
16                  0.66633175, 0.50676332, 0.6007552, 0.56892904, 0.49553407,
17                  0.61093935, 0.65057417, 0.40095626, 0.45969447, 0.51087888,
18                  0.52894806, 0.49397198, 0.4267163, 0.54091298, 0.34545257,
19                  0.58548892, 0.3137885, 0.63521146, 0.57541744, 0.59862265,
20                  0.66261386, 0.56744017, 0.42548488, 0.40841345, 0.47393027,
21                  0.60882106, 0.45961208, 0.43371424, 0.40876484, 0.64367337,
22                  0.54092033, 0.34240811, 0.44048106, 0.48874236, 0.68300902,
23                  0.33563968, 0.58328107, 0.58054283, 0.64710522, 0.3781285,
24                  0.36748982, 0.44386445, 0.47245989, 0.297599, 0.50295541,
25                  0.39785732, 0.51370486, 0.46650358, 0.5623638, 0.4446957,
26                  0.52949791, 0.54611411, 0.41020067, 0.61644868, 0.47493691,
27                  0.50611458, 0.42518211, 0.45467712, 0.52438467, 0.724529,
28                  0.59749142, 0.45940223, 0.53099928, 0.65159718, 0.38038268,
29                  0.51639554, 0.41847437, 0.46022878, 0.57326103, 0.44913632,
30                  0.61043611, 0.42694949, 0.43997814, 0.58787928, 0.36252603,
31                  0.50937634, 0.47444256, 0.57992527, 0.29381335, 0.50357977,
32                  0.42469464, 0.53049697, 0.7163579, 0.39741694, 0.41980533,
33                  0.68091159, 0.69330702, 0.50518926, 0.55884098, 0.48618324,
34                  0.48469854, 0.55342267, 0.67159111, 0.62352006, 0.34773486};
35
36
37          HistogramDataset dataset = new HistogramDataset();
38          dataset.addSeries("key", vals, 50);
39
40          JFreeChart histogram = ChartFactory.createHistogram("Normal distribution",
41                  "y values", "x values", dataset);
42
43          ChartUtils.saveChartAsPNG(new File("histogram.png"), histogram, 450, 400);
44      }
45  }
46
```

jFreeChart examples XYLineChart

```java
import java.awt.Color;

public class XYLineChart_AWT extends ApplicationFrame {

    public XYLineChart_AWT( String applicationTitle, String chartTitle ) {
        super(applicationTitle);
        JFreeChart xylineChart = ChartFactory.createXYLineChart(
            chartTitle ,
            "Category" ,
            "Score" ,
            createDataset() ,
            PlotOrientation.VERTICAL ,
            true , true , false);

        ChartPanel chartPanel = new ChartPanel( xylineChart );
        chartPanel.setPreferredSize( new java.awt.Dimension( 560 , 367 ) );
        final XYPlot plot = xylineChart.getXYPlot( );

        XYLineAndShapeRenderer renderer = new XYLineAndShapeRenderer( );
        renderer.setSeriesPaint( 0 , Color.RED );
        renderer.setSeriesPaint( 1 , Color.GREEN );
        renderer.setSeriesPaint( 2 , Color.YELLOW );
        renderer.setSeriesStroke( 0 , new BasicStroke( 4.0f ) );
        renderer.setSeriesStroke( 1 , new BasicStroke( 3.0f ) );
        renderer.setSeriesStroke( 2 , new BasicStroke( 2.0f ) );
        plot.setRenderer( renderer );
        setContentPane( chartPanel );
    }

    private XYDataset createDataset( ) {
        final XYSeries firefox = new XYSeries( "Firefox" );
        firefox.add( 1.0 , 1.0 );
        firefox.add( 2.0 , 4.0 );
        firefox.add( 3.0 , 3.0 );

        final XYSeries chrome = new XYSeries( "Chrome" );
        chrome.add( 1.0 , 4.0 );
        chrome.add( 2.0 , 5.0 );
        chrome.add( 3.0 , 6.0 );

        final XYSeries iexplorer = new XYSeries( "InternetExplorer" );
        iexplorer.add( 3.0 , 4.0 );
        iexplorer.add( 4.0 , 5.0 );
        iexplorer.add( 5.0 , 4.0 );

        final XYSeriesCollection dataset = new XYSeriesCollection( );
        dataset.addSeries( firefox );
```

Homework

- Visualize f(x)=x^2

- Visualize the histogram of 100 random numbers

- Visualize gold price since 1970 using date set from https://datahub.io/core/gold-prices